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EXAMINER

MALSAWMA, LALRINFAMKIM HMAR

ART UNIT PAPER NUMBER

2825

DATE MAILED: 05/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/780,390

Applicant(s)

RHODES ET AL.

Examiner

Lex Malsawma

Art Unit

2825

AS

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7,9-87 and 106-114 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7,9-15,20-27,50-61,64-66,106-109 and 112-114 is/are rejected.
- 7) ☒ Claim(s) 16-19,28-49,62,63,67-87,110 and 111 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Claim Objections

1. Claims 28-49, 50, 67 and 106 are objected to because of the following informalities:

Regarding Claims 28-49:

At claim 28, line 10, "said first active layer" should read "said first **doped** active layer".

Claims 29-49 are objected to because they depend from claim 28.

Regarding Claim 50:

In line 8), "said first doped layer" should read "said first doped **photoactive** layer"; and in lines 10-12, "second photoactive layers" should read "second **doped** photoactive layers".

Regarding Claims 67, 62, 63 and 68-87:

In lines 13 and 15, "said first photoactive layer" should read "said first **doped** photoactive layer". Claims 62, 63 and 68-87 are objected to because they depend from claim 67.

Regarding Claim 106:

In line 4, "said doped active layer" should read "said **first** doped active layer"; and in line 6, "second active layers" should read "second **doped** active layers".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 76 and 112 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Regarding Claim 76:

This claim requires a first doped region in addition to the third doped region (specified in lines 14-15 of claim 67) wherein both first and third doped regions must be located beneath the isolation region and the third doped region must be spaced apart from the first doped photoactive layer while the first doped region must be space away from the edge of the isolation region. In other words, in Fig. 3 of the current invention, four distinct doped regions are defined and the regions recited in claims 67/76 would be as follows:

- a first doped photoactive layer 130;
- a second doped photoactive layer 110 formed within first doped photoactive layer 130;
- a third doped region 140 beneath the isolation region 120 as spaced apart from first doped photoactive layer 130; and
- a first doped region 112.

In view of the current specification and drawings, the "first doped region 112" (of the instant claim) cannot be spaced away from the edge of the isolation region 112; therefore, the limitation in claim 76 fails to comply with the enablement requirement.

Regarding Claim 112:

This claim requires a fourth doped active layer to be located at least partially within the third doped active layer. Since the third doped active layer (specified in claim 106) would be

“region 140” in Fig. 3, the current specification and drawings do not describe how a fourth doped active layer would be located within “region 140”; therefore, the instant claim fails to comply with the enablement requirement.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 20-23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding Claims 20 and 21:

At claim 20, line 3, “said third doped active layer” lacks antecedent basis. Examiner interprets it as “said first doped active layer” because the fourth doped active layer (of claim 20) would be “region 110” in Fig. 3 of the drawings and the first doped active layer (in claim 1) would be “region 130” in Fig. 3, i.e., “region 110” is at least partially within “region 130”. Note that “said third doped active layer” cannot be interpreted as “said third doped region” (as recited in claims 1 and 9) because there is no disclosure in the current specification/drawings to indicate that a “fourth doped active layer” is formed at least partially within the third doped region, where the third doped region (as recited in claims 1 and 9) would be “region 140” in Fig. 3. Note: At claim 21, line 3, “said third doped active layer” is also interpreted as “said first doped active layer”.

Regarding Claims 22 and 23:

These claims are rejected as being dependent upon an indefinite claim (i.e., claim 20).

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1, 2, 4, 9, 10, 24-27, 50, 51, 53, 58, 60, 65, 66, 106, 113 and 114 are rejected under 35 U.S.C. 102(e) as being anticipated by Connolly et al. (6,259,145; hereinafter, “Connolly”).

Regarding Claims 1, 2, 4, 9, 10, 50, 51, 53 and 106:

Connolly discloses (in Fig. 1) a diode (or photodiode) comprising:

an isolation region 18 formed in a substrate by Shallow Trench Isolation “STI” (Col. 2, lines 12-16);

a first doped active layer 12a comprising a first conductivity type (n-type) formed in said substrate, wherein said doped active layer 12a is spaced apart from the isolation region;

a second doped active layer 10 of a second conductivity type (p-type) in contact with said first doped active layer 12a, the contact of a said first and second active layers forming a p-n junction (Col. 2, lines 37-38); and

a third doped region 20 (p-type) formed in said second doped active layer 10 beneath said isolation region 18, wherein said third doped region is spaced away from an edge of said isolation region at a surface of said substrate. *Specifically regarding Claim 50:* Connolly

discloses image sensors (or imager devices) are integrated with microprocessors and imaging devices include photodiodes (note Col. 1, lines 14-16 and 28-30); therefore, these claims are anticipated.

Regarding Claims 24-27, 65, 66, 113 and 114:

Connolly discloses that photodiodes are commonly used in CCD imager arrays, CMOS imager array, memory arrays and logic devices (Col. 1, lines 14-26); therefore, these claims are anticipated.

Regarding Claims 58 and 60:

Connolly discloses a first doped region 10 of the second conductivity type (p-type) under said isolation region 18 (Fig. 1).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 3, 15, 52 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over by **Connolly** (6,259,145) in view of **Chang** (6,140,670).

Regarding Claim 3, 52 and 54:

Connolly anticipates the diode of claim 1 but **lacks** the isolation region being a field oxide (FOX) region formed by Local Oxidation of Silicon (LOCOS) process. Chang **teaches** a diode similar to that disclosed by Connolly, wherein the isolation region 104 is a FOX region formed by LOCOS (note Chang, Fig. 2C and Col. 3, lines 10-13). It is important to note that Chang's device is very to similar to Connolly's device; and given both references, one of ordinary skill in the art would have readily recognized that the isolation region in either Connolly or Chang could be formed by either a LOCOS process or a Shallow Trench Isolation (STI) process. Therefore, it would have been an obvious matter of design choice for one of ordinary skill in the art to modify Connolly by incorporating a FOX region formed by LOCOS (instead of the specified STI process) because Chang teaches/shows that a device very similar to that disclosed by Connolly can also be formed with a FOX region formed by LOCOS.

Regarding Claim 15:

Connolly anticipates the diode of claim 1 and discloses the first doped active layer is an n-type active layer and the second doped active layer 10 is p-type. However, Connolly **lacks** specifying the second doped active layer as a p-well. Chang **teaches**, in a device similar to that disclosed by Connolly, that the substrate 200 (note Chang, Fig. 2C and Col. 3, lines 7-10), which would be equivalent to Connolly's "layer 10", can be a p-type substrate or a p-well of an n-type

substrate. Given Chang, one of ordinary skill in the art would have readily recognized that "layer 10" in Connolly could be specified as a p-well. Therefore, it would have been an obvious to one of ordinary skill in the art to modify Connolly by specifically referring to "layer 10" as a p-well because Chang teaches/shows that, in a device similar to that disclosed by Connolly, it would be a matter of design choice to utilize a p-well for "layer 10".

11. Claims 5-7, 11-14, 55-57, 59, 61, 64 and 107-109 are rejected under 35 U.S.C. 103(a) as being unpatentable over by **Connolly** (6,259,145).

Regarding Claims 5-7, 55-57 and 59:

Connolly anticipates claims 1 and 50 but **lacks** specifying any particular range for a space between the first doped active region 12a and the isolation region 18; however, in Col. 2 (lines 43-47), Connolly discloses that the space 22 between region 12a and isolation region 18 "depends on the particular characteristics of the device in question. The width of the regions 22 may be adjusted to sufficiently reduce the leakage current to achieve desirable results".

Therefore, it would have been obvious to one of ordinary skill in the art to modify Connolly by specifying a range as in the instant claims, since Connolly discloses the general conditions of the claimed invention, and it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

In re Aller, 105 USPQ 233.

Regarding Claims 11, 12, 61 and 107:

It was very well known and common in the art to utilize phosphorous, arsenic, or antimony as an n-type dopant in the manufacture of semiconductor devices; therefore, it would

have been an obvious matter of design choice for one of ordinary skill in the art to specifically utilize any one of the well-known n-type dopants.

Regarding Claims 13, 14, 64, 108 and 109:

Connolly **lacks** specifying any particular dopant-dosage range for the first doped region, however, it is important to note that the general conditions of the claimed invention are disclosed. Therefore, it would have been obvious to one of ordinary skill in the art to specify a range for dopant dosage (as in the current claim) because Connolly discloses the general conditions of the claimed invention, and it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Allowable Subject Matter

12. Claims 28-49, 62, 63, 67-75 and 77-87 (all as interpreted/understood) are allowable over the references of record.
13. Claims 16-19, 20-23 (as interpreted/understood), 110 and 111 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
14. The following is a statement of reasons for the indication of allowable subject matter:
Claims 28-49, 62, 63, 67-75 and 77-87 are allowable primarily because claims 28 and 67 require a second doped active layer to be formed within the first doped active layer. This

limitation in combination as recited in claims 28 and 67 cannot be anticipated or rendered obvious by the references of record. NOTE: Objections were made to claim 28 and 67.

Claims 16-19, 110 and 111 would be allowable primarily because claims 16 and 110 require a fourth doped active layer at least partially within the first doped active layer.

Claims 20-23 (as interpreted/understood) would be allowable primarily because claim 20 requires a fourth doped active layer at least partially within the first doped active layer.

Remarks

15. The indicated allowability of claims 9, 20-23, 36, 59 and 76 (in the previous Office Action) is withdrawn in view of the newly discovered reference(s) to Connolly (6,259,145). Rejections based on the newly cited reference(s) have been presented above.

16. Applicant's remarks/arguments have been carefully reviewed and considered; however, a new reference has been cited and all pending claims have been reconsidered. Applicant's remarks/arguments are moot in view of the new ground(s) of rejection.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lex Malsawma whose telephone number is 571-272-1903. The examiner can normally be reached on Monday through Thursday (8 AM - 6 PM EST).

Art Unit: 2825

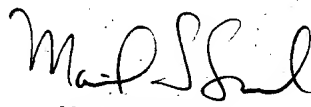
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Lex Malsawma



May 17, 2004



MATTHEW SMITH
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